

## REMARKS

Support for correction of "1,2:5,6-dianhydro-xylitol" to "1,2:4,5-dianhydro-xylitol" is found at page 4, lines 27-30.

As applied to claims 6 and 29 the rejection for indefiniteness is moot in view of the present cancellation of those claims. Further, the rejection is also believed to be moot as applied to claim 28 because recitation of "1,2-anhydro-annitol", the only species not a dianhydro sugar, has been dropped from the claims.

The new prior art rejection of claims 1, 3-5, 7 and 8 for anticipation by Satoh et al is respectfully traversed. As basis for the rejection, the Examiner notes, toward the bottom of page 4 of the office action, "they [the copolymers of Satoh et al] are disclosed as random copolymers, having a variety of linkages." However, as the Examiner notes toward the top of page 4 of the office action that "variety of linkages" consists of the (1 → 6), (6 → 1), (1 → 1) and (6 → 6) linkages, **all of which** give a **linear structure**, wherein the degree of branching is zero. Branching would require linkages at the C3 and/or C4 positions, none of which linkages are taught or suggested by Satoh et al.

Satoh et al. disclose a polymer (4) of 1,2:5,6-dianhydro-3,4-di-O-methyl-L-iditol(3), and a copolymer (6) of this polymer and 1,2:5,6-dianhydro-3,4-di-O-methyl-D-mannitol (1). However, these are linear polymers having 2,5-anhydro-3,4-di-O-methyl-D-glucitol as a structural unit. This is clear from the chemical structural formulae shown in Scheme 1 (on page 6682) and Scheme 4 (on page 6684).

Satoh et al. reports that the copolymer is a random copolymer consisting of (1 → 6)-, (6 → 1)-, (1 → 1)- and (6 → 6)-linked 2,5-anhydro-3,4-di-O-methyl-glucitol (abstract). The meaning of the "random copolymer" as used by Satoh et al is that the direction of

polymerization is (1→6), (6→1), (1→1) or (6→6), and the stereoregularity is random.

Satoh et al specifically teach that, in polymerization, the binding positions of carbon atoms are only at the 1<sup>st</sup> and 6<sup>th</sup> positions. “Random copolymer” does not mean that the binding positions of carbon atoms are random.

As described in Scheme 4 of Satoh et al, the 3<sup>rd</sup> and 4<sup>th</sup> positions are kept as methyl ether, and they are not involved in the polymerization. Thus, the copolymer does not become a branched polymer, but becomes a linear polymer.

As explained above, Satoh et al. reports that the copolymer is a linear polymer. Consequently, although the Examiner asserts that “therefore, it is considered likely that the products have some degree of branching and thus meet the limitations of the claims” (page 4, lines 1-3 from the bottom), this is clearly incorrect. Perhaps the Examiner incorrectly understood “random copolymer” in Satoh et al. To mean that the binding positions of the carbon atoms are random.

According to the Examiner, the polymer of (2) and polymer of (4) in Satoh et al. might have “some degree of branching”, but that is not correct. In order to possess branched structure, bonding is necessary, not only at the C1 and C6 positions, but also at the C3 and C4 positions. However, the bonds of the copolymer (6) described in Satoh et al. are only at C1 and C6 positions.

Furthermore, for example, although the monomer (3) in Satoh et al. is 1,2:5,6-dianhydro-3,4-di-O-methyl-L-iditol, the present invention does not include a monomer in which all the hydroxyl groups are protected by alkyl groups, such as the monomer (3) in Satoh et al.

In the present invention, at least one of the groups at C3 and C4 positions is a

hydroxyl group, and a polymerization reaction in which the hydroxyl group is involved also occurs whereby a polymer having branched structure is formed.

Since all the hydroxyl groups are protected by methyl groups in Satoh et al., Satoh et al. relates only to a polymerization and copolymerization of monomer (1) and (3) which does not result in a branched structure. In other words, the presence of the protecting methyl groups at the C3 and C4 positions in Satoh et al. precludes any possibility of branching.

While the process of the present invention is similar to that of Satoh et al., the present invention is directed to polymerization of monomer having hydroxyl groups which is different from the monomer used in Satoh et al. Therefore, the structure of the polymer generated in the present invention is also completely different from that in Satoh et al., i.e., the polymer of Satoh et al. is a linear polymer whereas the polymer of the present invention is a hyperbranched polymer.

The Examiner's rejection is based on a theory of inherency. As noted in MPEP §2112, "The fact that a certain result or characteristic may occur or be present in the prior art is not sufficient to establish inherency of that result or characteristic.", citing *In re Rijchaert*, 9 F.3d 1531, 1534, 28 USPQ2d 1955 (Fed. Cir. 1999). *Rijchaert* held:

To establish inherency, the extrinsic evidence 'must make clear that the missing descriptive matter is necessarily present in the thing described in the reference, and that it would be so recognized by persons of ordinary skill. Inherency, however, may not be established by probabilities or possibilities. The mere fact that a certain thing may result from a given set of circumstances is not sufficient.'"

Here, the Examiner has given no rationale for anything rising even to the level of a possibility. Indeed, the Examiner's theory is contradicted by the explicit teachings of the

reference itself as to the nature of the bonds linking the monomeric units.

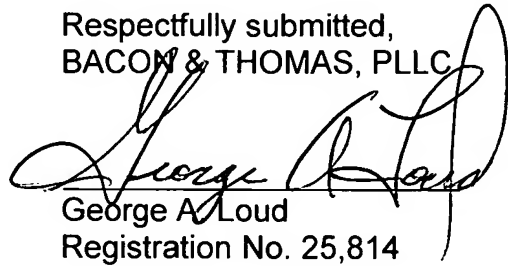
Even if the Examiner had made a case sufficient to support a theory of inherency, that alone would not have established grounds for an anticipation rejection. While, as noted above, the protecting methyl groups do not allow for "some branching" (the Examiner's words), even "some branching" would not give a "hyperbranched polymer". In the polymer art "hyperbranched" has a recognized meaning. Vladimirov, Encyclopedia of Chromatography, "Dendrimers and Hyperbranched Polymers: Analysis by GPC/SEC" (attached) gives the following definition:

"Dendrimers and hyperbranched polymers are globular macromolecules having a highly branched structure, in which all bonds converge to a focal point or core, and a multiplicity of reactive chain ends."

The independent process claims, previously withdrawn from consideration, have been amended to include all limitations of allowable product claims and rejoinder is requested.

For the foregoing reasons, reconsideration of the rejections is respectfully requested.

Respectfully submitted,  
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# Dendrimers and Hyperbranched Polymers: Analysis by GPC/SEC

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## Abstract

Dendrimers and hyperbranched polymers are globular macromolecules having a highly branched structure, in which all bonds converge to a focal point or core, and a multiplicity of reactive chain ends. Because of the obvious similarity of their building blocks, many assume that the properties of these two families of dendritic macromolecules are almost identical and that the terms "dendrimer" and "hyperbranched polymer" can be used interchangeably. These assumptions are incorrect because only dendrimers have a precise end-group multiplicity and functionality. Furthermore, they exhibit properties totally unlike that of other families of macromolecules.

**Keywords:** dendrimers; hyperbranched polymers; GPC/SEC; branching density

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